Met Office

NEWS

# New model to enhance extreme rainfall prediction

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## Scientists have developed new guidance and tools that could significantly improve the prediction of life-threatening flash flooding.

New research by an international team of climate experts shows intense, localised, heavy bursts of rainfall can be caused by a rapid rise of air through clouds and proves that these rises in air can be forecast. The team have developed a unique, cutting-edge modelling system marking a fundamental change in how we identify and forecast life threatening, short-duration, extreme rainfall. Better prediction of these intense downpours will help provide crucial time for communities to prepare for extreme weather which can lead to devastating flash floods such as was seen in Boscastle in August 2004 or London in August 2022.

Published in the journal *Weather and Climate Extremes*, the study was led by the Met Office and Newcastle University, with support from the Universidad de Costa Rica, San Jose, Costa Rica and the Adam Mickiewicz University, Poznań, Poland.

Study lead author, Met Office Principal Fellow, and Visiting Professor at Newcastle University's School of Engineering, Paul Davies, said: "The new model is aimed at enhancing the UK's resilience to extreme weather events, which are becoming more frequent and intense due to climate change. This approach addresses the urgent need for improved prediction capabilities and will help both UK and global communities in mitigating the risks associated with increasingly extreme weather events."

Paul added: "In order to understand these extreme rainfall events we have made an exciting discovery: the presence of a three-layered atmospheric structure, consisting of Moist Absolute Unstable Layers sandwiched between a stable upper layer and a near-stable low layer."

The new research focuses on the atmospheric properties of the extreme rainfall environment, with a particular focus on the thermodynamics associated with sub-hourly rainfall production processes. It identifies a distinctive three-layered atmospheric structure crucial to understanding localised downpours. and associated large-scale atmospheric regimes which might enable further-ahead prediction of the occurrence of extreme downpours and flash flooding.

### Extreme weather conditions

Study co-author, Hayley Fowler, Professor of Climate Change Impacts at Newcastle University, added: "I am delighted to help to lead such exciting new research which provides a paradigm shift in thinking about extreme rainfall processes. We will further develop this model into an operational system which can help to deliver on the

UN's call for Early Warnings for All, which aims to ensure universal protection from hazardous weather, water, or climate events through life-saving early warning systems by the end of 2027. With human-induced climate change leading to more extreme weather conditions, the need for accurate early warning systems is more critical now than ever before."

This research offers the potential to develop an 'extreme rainfall warning system enhancing the capability of forecasters and users to identify and predict dangerous flash floods, thereby improving public safety and preparedness.

The Met Office is a Category 2 Responder and is responsible for warning emergency responders and governments, and the public about the potential impacts from severe weather and the risks to life and property. Flooding can have severe impacts, and the Met Office works closely with partners, such as Environment Agency, the Scottish Environment Protection Agency, and Local Resilience Forum, etc. supporting the delivery of flood forecasts and warnings. The Met Office is also part of the Natural Hazards Partnership consortium which helps deliver co-ordinated assessments, research and advice on natural hazards for governments and resilience communities across the UK.

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